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V. *Part of a Letter from Monsieur Claud. Joseph Geoffroy, F. R. S. to David Hartley, M. A. F. R. S. containing his Method of making Soap-lees and Hard Soap, for Medicinal Uses.*

S I R, *Paris, July 23. 1741. N. S.*

*Read April 1.
1742.*

— **T**O make the Lye, I take, for Instance, of the best calcined Lime, that has been the least exposed to the Air, 5 lb; of good Salt of *Kali* or Glass-wort of *Alicant*, pulverized, and passed through a fine Sieve, 10 lb. I divide the Lime and the Salt of Glass-wort (called in *England Barillia*) into two equal Parts; then I put the Lime, broken into Pieces not bigger than an Egg, into new stone Pans, and cover it with as much Salt of Glass-wort as is designed for each Pan. I pour afterwards on these several Mixtures hot Water by little and little, to give Time to the Lime to open itself, till it turns into a sort of Meal, which will happen after I have poured Three half Pints * into each Pan. I then add to it the rest of the Water that is required, stirring this Mixture with a Stick of white Wood; when there are Eighteen or Nineteen Quarts of Water in each Pan, there is enough for dissolving the Salts. In this State the Pans are left for Twelve or Fifteen Hours; after which this Lye is filtrated

* The *Paris* Pint is, near a Quart *Englisb*.

through brown Paper, supported by a coarse Cloth, fixed to the Four Corners of the filtering Frame. When the whole Mass of the Lye and of the Lime is well drained, I put it into an iron Pot that is very clean, with Ten Quarts of Water, to the Quantity taken out of each Pan, and let it boil an Hour; then I filtrate it a second time. Afterwards it is put into another iron Pot that is very clean, and as it evaporates by Degrees, it is filled up again with the first Lye prepared, without boiling. I let it continue to evaporate till the Twenty-eight Quarts of Water, that have been used for making the Lye of the Mixture that was at first put into each of the Pans, be reduced to Two Quarts and half a Pint, or so long till a small salinous Film forms itself on the Top of the Lye. This Liquor turns almost black, because it corrodes the Iron; but this is no Inconvenience, as will appear hereafter. In this State of Concentration, if one lets a Drop of it, whilst it is hot, fall on a Piece of Glass, it will be very quickly covered with a fine and greasy Film, which makes it look as if it was congealed. At the Bottom of this Lye is found a Salt in Flakes, which, being melted in a Crucible, produces a *Lapis infernalis* of a strong caustic Power. One may know also, that the Lye has acquired the necessary Degree of Concentration, when, becoming more active, one sees, that the Edge of the Pot that has been wetted by it, turns red, whilst the lower Part of the Side all around, down to the Surface of the Liquor, takes a greenish Colour. Then the Pot must be taken from the Fire, and the Liquor left to cool so far as to be put into Glass Bottles without cracking them: The Bottles ought to be carefully corked,

corked, not only to prevent the Salts contracting a Dampness from the Air, which would lessen the Degree of forced Concentration, which has been acquired by the Evaporation, but also to preserve what is sulphureous, which would exhale, if the Liquor remained long exposed to the Air : For I suspect, that that sort of *Hepar*, formed by the Union of the caustic Salt with the Sulphur of the Ashes of the Glass-wort, ought not to be neglected. Now, the better to direct those who have a mind to work after these Processes, and to furnish them with the Degrees of Concentration this Lye is to have, in order to make with Oil a solid Soap out of it as speedily as possible, I take a glass Phial with a narrow Neck, and fill it with clear Water up to a Mark made on the Neck. That which I now make use of, being filled up with Water to that Mark, contains just Three Ounces : I afterwards empty it carefully, and, instead of clear Water, I fill it with that concentrated Lye as far as the foresaid Mark, and then I weigh it. If the Weight be increased Eight and an half or Nine Drams, that is, near Three Drams in each Ounce, this shews that the Lye is neither too much nor too little concentrated. An hydrostatical Balance, a Water-poise, and other Instruments, might also give this Degree ; but in the Country they are not at hand, and I judged it best to point out only what is most easy. Soap-boilers use for this End a fresh Egg ; if one half of it sinks into the Lye, they judge the latter to be of the first Strength, that is to say, that this is the Lye which they ought to employ last of all in their Manufacture ; if the Egg sinks in to Two-thirds, the Lye is called the Second ; and, lastly, if the Lye covers the whole

Surface of the Egg, it will be called the First, and will be that with which they begin their Operation or Boiling. But this way of trying has not all the Exactness which can be desired, because all Hens Eggs have not the same specific Gravity. Besides, as I make my Soap without Fire, I must take the Lye that is most concentrated.

Left the Iron, which is corroded by the Lye, should enter into the Composition of the Soap, one need only to evaporate the Lyes in earthen Pans put over a *Balneum Mariæ*; but as this Evaporation is slower, it will consume much more Coals. One may even see in those Pans by different Marks, that the Liquor approaches the desired Degree of Concentration, partly by a Piece of Wood marked with Notches, partly because if there is the least ferruginous Speck in the Earth of those Pans, the Liquor will penetrate that ferruginous Place, and make a Spot there. By using earthen Pans you will get a very limpid Liquor, and which will only have a very pale Straw-colour, even after its perfect Concentration.

The Lye prepared in Iron, being kept for some time, clears up, and leaves a black Sediment, which is that Part of the Iron which it has separated by corroding the Sides of the Pot. And yet this ferruginous Lye, together with the Oil, will form a white Soap, if one has let that black Sediment precipitate. This Sediment is true Iron: I have made myself sure of it, by calcining it in a Crucible, after having moistened it with Oil.

One Ounce of concentrated Lye to the Degree above-mentioned contains Three Drachms Eighteen Grains of Salt; when I dissolve this Salt again in
distilled

distilled Rain-water, and filtrate it, I find in it Three Grains of coarse Earth, which cannot penetrate the Pores of the Filtre.

If I use it to make Soap of it, I take one Part to two Parts of the best Oil: I mix them gently in a *China* Bowl, stirring them with a *Spathula* of white Wood, till both Liquors are come to a Consistence of Butter that is churning: This Thickening is much sooner done in Winter than in Summer. I keep the Vessel in a dry Place, that the Moisture of the Air may not diminish the Strength of the Lye. The Mixture from Day to Day grows to a Body, and when it is in the Sun in Summer, and upon the Mantle of the Chimney in Winter, the Phlegm evaporating sooner, it becomes perfect Soap in Four or Five Days, provided the Lye be sufficiently concentrated. It will be well however, that during the time the two Liquors are binding together, the Mixture be stirred with the *Spathula*, that the Water may not be kept in, but evaporate the sooner. When the Soap is made, it easily comes out of the Vessel, but it has not yet lost all that Moisture it should lose; so that though one may use it in that State, yet it is better to keep it Twelve or Fifteen Days longer; at the End of which Time if I decompound it, I always find the whole Oil I have employed; that is to say, out of Eighteen Drachms of this perfect Soap, I get one Ounce and an half of Oil, and Two Drachms Twenty-three or Twenty-four Grains of Salt of Glass-wort. So after this Method a Patient may easily make his own Soap, and be sure of the Ingredients; perhaps even in the great Manufacturies, one Day or other, they may prefer this to that which is now in Use.

As to what relates to the Oil of Lime *, of which I have spoken in my Experiments, it is the *Caput Mortuum* of the *Sal Ammoniac*, after Distillation of the volatile Spirit by the means of Quick-lime; it is exposed in a flat Vessel to the Moisture of the Cellar, whence a *Deliquium* is formed, which we call Oil of Lime. It is Lime dissolved by the means of the Acid of the Sea-salt, which is contained in the *Sal Ammoniac*; other Chymists call it the fixed Liquor of *Sal Ammoniac*. Your Soap-boilers are obliged to add Sea-salt to their Soap, which I believe, for my part, comes from their making use of Pot-ash in their Lyes, which they would have no occasion to have recourse to, if they employed true Salt of Glass-wort, seeing my strong Lye of Salt of Glass-wort makes Soap immediately; besides, the Salt of Glass-wort contains Sea-salt, which I have demonstrated by making Salt of *Glauber* with pure Salt of Glass-wort and Oil of Vitriol: If instead of Salt of Glass-wort one makes use of Pot-ash with Oil of Vitriol, it will not make Salt of *Glauber*, but instead of it produce Tartar vitriolate.

In describing this sort of Soap, I had no other View, than not to deviate from the way of making *Alicant Soap*, and to know well the Proportions, in order to apply them to the making of the Soap I propose, and to fix them with regard to the Lime and the Salt of Glass-wort, which for many and various Reasons is preferable to other fixed Salts, as being that which forms the best, the most deterfive,

* Huile de Chaux.

and the mildest Soap, as it has been found by Experience in all our Manufacturies.

The Observations which I have lately laid before the Academy, prove that the Oil, which has passed through the Lyes of Lime and of Salts, is, perhaps, easier to digest than any other. I there demonstrate, that the Oil separated from the Soap by the means of Acids, as I have pointed out, is found to have acquired a Property which it had not before; for it dissolves in Spirit of Wine, and perfectly unites with it; which it could not do whilst it was crude, that is to say, before it had formed Soap, or had been boiled with metallic Limes.

VI. *A Letter written to the most Reverend Father D. Cla. Fremond Calmad, publick Professor in the University of Pisa, giving an Account of the Earthquakes felt in Leghorn, from the 16th to the 27th of January 1742. With some Observations made by the most Reverend Sig. Pasqual R. Pedini, Principal of the Clergy of the most eminent College of the said City. Communicated to the ROYAL SOCIETY by James Jurin, M.D. F. R. S. &c.*

Read April 8.
1742.

IN Obedience to your Commands, I transmit you an Account of the Earthquakes felt in *Leghorn*, from the 16th to the 27th of *January*.